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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/765,301	LESLIE, TERRENCE C.	
	Examiner	Art Unit	
	Matthew C. Landau	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-8,10-30,32-40 and 71-110* is/are pending in the application.

4a) Of the above claim(s) *5-7,21-23,28,29 and 92-110* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-4,8,10-20,24-27,30,32-40 and 71-91* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 January 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Newly submitted claims 92-110 are withdrawn from consideration as being drawn to non-elected species. Claim 92 is drawn to non-elected species IV (Fig.14 and 15), while claim 96 is drawn to non-elected species II (Fig. 11). Therefore, claims 5-7, 21-23, 28, 29, and 92-110 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on September 23, 2005.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "abrupt p-n junction" (claim 72) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 12, 19, 72, and 74-76 (and all claims depending therefrom) are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claim 74, the limitation "wherein the selective epitaxy mesa comprises a portion of a buried conductive path, and wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type" is not sufficiently supported by the originally filed application. The limitation refers to a first region ("a portion of a buried conductive path") and a second region ("a region of the selective epitaxy mesa adjacent to the buried conductive path"). Since the first region is part of the conductive path, then the second region, which is adjacent to

the conductive path, must be referring to a separate region. In terms of Applicant's drawings (Figures 4A and 4B), if the first region refers to region 37, then the second region must refer to the portion of region 36 above region 37 (as in Figure 4A) or the portion of region 36 in the middle of region 37 (as shown in Figure 4B). However, since region 36 is undoped, it cannot have a dopant profile and consist essentially of dopant of one conductivity type as required by the claim. Therefore, the above limitation constitutes new matter. Note that claim 75 has the same problem, while claims 76 has a very similar problems, despite a slight difference in wording.

Regarding claims 12 and 19, the limitation "the first source/drain region extends horizontally around the selective epitaxy mesa" (in conjunction with the limitations of claim 75) is not sufficiently supported by the originally filed application. Although claim 12 is an original claim, claim 1 has been amended throughout the prosecution. The above limitation reads on the embodiment shown in Figure 4B. However, the embodiment shown in Figure 4B has doped regions 37 formed by horizontal diffusion (see page 11, lines 21-23). Since the doped regions are formed in this manner, they cannot have a "laterally non-graded dopant profile" as required by claim 1. Although Figure 4A could support having a "laterally non-graded dopant profile", this embodiment does not disclose having the "first source/drain region extends horizontally around the selective epitaxy mesa". The specification does not disclose an embodiment that has both the above mentioned claimed features. Therefore, the above limitation constitutes new matter. Note that claim 19 has the same problem.

Regarding claim 72, the limitation "the region of the selective epitaxy mesa adjacent to the buried conductive pate comprises at least one abrupt p-n junction" is not sufficiently

supported by the originally filed application. There is no disclosure of a mesa having a p-n junction. The specification describes having an undoped channel (body), meaning there would be no p-n junction between the source/drain regions and the channel. Therefore, the above limitation constitutes new matter.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 74-77 (and all claims depending therefrom), 83, 85 (and all claims depending therefrom), and 91 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 74, the limitation "wherein the selective epitaxy mesa comprises a portion of a buried conductive path, and wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type" renders the claim indefinite. It is unclear what is meant by this limitation. Does this mean that the "a region of the selective epitaxy mesa adjacent to the buried conductive path" is a separate region from "a portion of a buried conductive path"? Or are both limitations referring to the same region? As shown in Figures 4A and 4B (of the present application), it appears "a portion" from the limitation "the selective epitaxy mesa comprises a portion of a buried conductive path" refers to region 37. Therefore, does the limitation "a region

of the selective epitaxy mesa adjacent to the buried conductive path" also refer to region 37, or does it refer to the portion of region 36 above region 37 (as in Figure 4A) or the portion of region 36 in the middle of region 37 (as shown in Figure 4B). If region 37 is part of the conductive path, it would be improper to say it is adjacent the conductive path. However, since region 36 is undoped, it cannot have a dopant profile and consist essentially of dopant of one conductivity type as required by the claim. It appears from the specification and drawings that both limitations are referring to the same region. If so, it is suggested Applicant amend the claim to clarify that point. If not, then the limitations constitute new matter as indicated above. Note that claim 75 has the same problem, while claim 76 has a very similar problem, despite a slight difference in wording.

Further regarding claim 76, does "a first doped region" also refer to the same region as "a portion of the selective epitaxy body" and "a region of the selective epitaxy body"? It appears from the specification and drawings that it does. All three regions appear to be represented as region 37 in Figures 4A and 4B. Furthermore, it is unclear what is meant by "a vertical portion" of a buried bit line. Does this mean the bit line extends in a vertical direction? Also, the limitation "the second doped region" lacks sufficient antecedent basis in the claim.

Regarding claims 77 and 85, the limitation "a first and second insulator forming a portion of the annular depression" renders the claim indefinite. It is unclear how the insulators can "form" a depression. It is suggested this limitation be amended to more clearly recite that the depression is formed in the insulators, or that a hole in the insulators forms the depression. Also, the limitation "the mesa circumferentially contacting the buried conductive path at a specified radius above the first insulator" renders the claim indefinite. It is unclear what is mean by "at a

specified radius". How is the radius used to indicate a vertical position "above the first insulator"? Note that claim 85 has the same problem.

Regarding claim 83 and 91, the limitation "the mesa electrically contacts the buried conductive path only at the specified radius" renders the claim indefinite. Considering a radius is a length measure equivalent to ½ the diameter of a circle, it is unclear how the mesa can be considered to contact the conductive path at a radius. What structure is intended to be claimed by the use of this limitation? Note that claim 91 has the same problem.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 2-4, 8-11, 16-18, 24-27, and 71-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Fitch et al. (US Pat. 5,451,538, hereinafter Fitch).

Regarding claims 16 and 26, Figure 10 of Fitch discloses a substrate 12; an electrical signal line (bit line) 14 (col. 7, lines 46-48) on the substrate; an access device including: a selective epitaxy mesa (28/30/32/34) formed on and extending outwardly from the substrate, the selective epitaxy mesa including a first S/D region 28 adjacent the substrate and in electrical communication with the electrical signal line, wherein the first S/D region 28 includes a lateral non-graded dopant profile consisting essentially of dopant atoms of one conductivity type (col. 4,

lines 43-48), the selective epitaxy mesa further including a body 30 extending vertically from the first S/D region 28, an insulator 22 on the body, and a gate 18 on the insulator; and a storage device 69 on the selective epitaxy mesa.

Regarding claim 17, Figure 10 of Fitch discloses the electrical signal line14 has a first height (depth), and wherein the first S/D region 28 has a second height (thickness) equal to or less than the first height.

Regarding claim 18, Figure 10 of Fitch discloses the selective epitaxy mesa (28/30/32/34) cantilevers upwardly from the substrate, and wherein the selective epitaxy mesa includes an end, remote from the substrate, forming a second S/D region 32/34.

Regarding claim 24, Figure 10 of Fitch discloses the first S/D region 28 is adapted to electrically communicate with a column address decoder through a buried bit line 14.

Regarding claim 25, Figure 10 of Fitch discloses the second S/D region 23/34 is adapted to electrically communicate with the storage device.

Regarding claim 27, Figure 6 of Fitch discloses the insulator 22 surrounds the body 30, and wherein the gate 18 surrounds the insulator such that the gate effects electrical conductivity of the body from more than one angle.

Regarding claims 74 and 75, Figure 10 of Fitch discloses a substrate 12; a vertical access device including a selective epitaxy mesa (28, 30, 32, and 34), wherein the selective epitaxy mesa comprises a portion of a buried conductive path (28/14), and wherein a region 30 of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type (col. 4, lines 60-63); and a storage device 69 on the selective epitaxy mesa. Note that Figure 4 of Fitch discloses that

layers 28, 30, 32, and 34 are selectively formed by epitaxial growth techniques (col. 4, lines 30-36). Also note that Fitch discloses region 14 is the bit line (col. 7, lines 46-48), and therefore inherently has a conductive path. Region 28 can be considered part of that conductive path since it is electrically connected to region 14.

Regarding claim 2, Figure 10 of Fitch discloses the selective epitaxy mesa (28, 30, 32, and 34) includes a bottom source/drain (S/D) 28 and a top S/D 32/34, and a conductive body 30 separating the bottom S/D from the top S/D.

Regarding claim 3, Fitch discloses the bottom S/D region 28 is an in situ doped region (col. 4, lines 43-48).

Regarding claim 4, Fitch discloses the top S/D region 32/34 is an in situ doped region (col. 5, lines 3-10).

Regarding claim 8, Figure 10 of Fitch discloses the access device is free from a shallow trench isolation layer.

Regarding claim 10, Fitch discloses the substrate 12 includes silicon (col. 3, line 10), and wherein the selective epitaxy mesa includes silicon (col. 4, lines 36-41).

Regarding claim 11, Figure 10 of Fitch discloses the access device includes a body 30, a first S/D region 28, a gate 18 and a second S/D region 32/34, wherein the body extends between the first S/D region and the second S/D region, and wherein the first S/D region and the second S/D region are each a selective epitaxy doped region of the selective epitaxy mesa (col. 4, lines 43-48 and col. 5, lines 3-10).

Regarding claim 71, Figure 10 of Fitch discloses the selective epitaxy mesa includes a region of polycrystalline silicon (col. 5, lines 44-46).

Regarding claims 72 and 73, Figure 10 of Fitch discloses the region 28 of the selective epitaxy mesa adjacent to the buried conductive path comprises at least one abrupt p-n junction (the junction between region 30 and region 28). Region 28 is abruptly doped.

Claims 2-4, 8-11, 16-18, 24, 25, and 72-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Maeda et al. (US Pat. 6,303,425, hereinafter Maeda).

Regarding claims 74 and 75, Figures 2, 13-15, and 33 of Maeda disclose a substrate 1; a vertical access device including a selective epitaxy mesa 11/12/13 formed on and extending outwardly from the substrate, wherein the selective epitaxy mesa comprises a portion (doped region 11) of a buried conductive path 31/30 (Fig. 33), and wherein a region (the doped region) of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type; and a storage device 26/21/22 (capacitor) on the selective epitaxy mesa. Note that in the embodiment of Fig. 33, when the selective epitaxy mesa is grown, the doped region 11 will laterally contact region 31, which is in contact with region 30. Region 30 is equivalent to region 24 of Fig. 2, and both are the bit line (BL) (buried conductive path) (col. 14, lines 20-24 and col. 19, line 25). Region 31 can be considered part of the buried conductive path since it is electrically connected to the BL 30. Also note that region 11 (region 6a) is doped using ion-implantation and diffusion (col. 17, lines 14-20). Since the implantation/diffusion occurs in from the vertical direction, the dopant profile will not be graded in the lateral direction.

Regarding claims 2 and 11, Figures 2 and 13-15 of Maeda disclose the selective epitaxy mesa 11/12/13 (or 6a/12/6b as shown in Fig. 14) includes a bottom (first) S/D region 11(or 6a) and a top (second) S/D region 13(or 6b), and wherein the selective epitaxy mesa further includes a conductive body 12 separating the bottom S/D from the top S/D region, and wherein the first S/D and the second S/D region are each a selective epitaxy doped region of the selective epitaxy mesa (col. 17, lines 7-20).

Regarding claim 3, the limitation "the bottom source/drain region is an in situ doped region" is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966.

Regarding claim 4, the limitation "the top source/drain region is an in situ doped region" is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art.

Regarding claim 8, Figure 2 of Maeda discloses the access device is free from a shallow trench isolation layer.

Regarding claim 10, Figure 2 of Maeda discloses the substrate 1 includes silicon (col. 14, lines 18-20), and wherein the selective epitaxy mesa includes silicon (col. 17, lines 7-10).

Regarding claim 16, Figures 2, 13-15, and 33 of Maeda disclose a substrate 1; an electrical signal line (bit line) 30/31 on the substrate; an access device including: a selective epitaxy mesa 11/12/13 (or 6a/12/6b as shown in Fig. 14) formed on and extending outwardly

from the substrate, the selective epitaxy mesa including a first S/D region 11 (or 6a) adjacent the substrate and in electrical communication with the electrical signal line, wherein the first S/D region includes a lateral non-graded dopant profile consisting essentially of dopant atoms of one conductivity type (col. 4, lines 43-48), the selective epitaxy mesa further including a body 12 extending vertically from the first S/D region, an insulator 4 on the body, and a gate 25 on the insulator; and a storage device 26/21/22 on the selective epitaxy mesa. Note that in the embodiment of Fig. 33, when the selective epitaxy mesa is grown, the doped region 11 will laterally contact region 31, which is in contact with region 30. Region 30 is equivalent to region 24 of Fig. 2, and both are the bit line (BL) (buried conductive path) (col. 14, lines 20-24 and col. 19, line 25). Region 31 can be considered part of the buried conductive path since it is electrically connected to the BL 30. Also note that region 11 (region 6a) is doped using ion-implantation and diffusion (col. 17, lines 14-20). Since the implantation/diffusion occurs in from the vertical direction, the dopant profile will not be graded in the lateral direction.

Regarding claim 17, Figures 2 and 33 of Maeda discloses the BL 30/31 has a first height (combined height of regions 30 and 31), and wherein the first S/D region 11 (or 6a) has a second height equal to or less than the first height.

Regarding claim 18, Figure 2 of Maeda discloses the selective epitaxy mesa 11/12/13 cantilevers upwardly from the substrate, and wherein the selective epitaxy mesa includes an end, remote from the substrate, forming a second S/D region 13 (or 6b of Figure 14).

Regarding claim 24, Figure 2 of Maeda discloses the first S/D region 11 is adapted to electrically communicate with a column address decoder through a buried bit line 24.

Regarding claim 25, Figure 2 of Maeda discloses the second S/D region 13 is adapted to electrically communicate with the storage device.

Regarding claims 72 and 73, Figure 2 of Maeda discloses the region 11 of the selective epitaxy mesa adjacent to the buried conductive path comprises at least one abrupt p-n junction (the junction between region 11 and region 12). Region 11 is abruptly doped.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 32-40 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fitch in view of Chew et al. (US Pat. 6, 518,622, hereinafter Chew).

Regarding claims 32 and 76, Figure 10 of Fitch discloses a vertical, selective epitaxy body (28/30/32/34) extending from a horizontal substrate 12 such that a portion of the selective epitaxy body is adapted to comprise a vertical portion 28 of a buried bit line 14 (col. 7, lines 46-48), wherein a region 28 of the selective epitaxy body adjacent to the vertical portion includes a laterally non-graded dopant profile consisting essentially of dopant of once conductivity type; a first doped region 28 in the body adjacent the substrate; a second doped region 32/34 in the body remote from the substrate; an intermediate region 30 (channel region) between the first doped region and the second doped region; and a gate 18 at least partially surrounding the intermediate

region. Note that region 28 can be considered part of the bit line since it is electrically connected to region 14. The difference between Fitch and the claimed invention is the intermediate region (channel region) is undoped. Figure 6 of Chew discloses a vertical access device with an undoped, epitaxial channel region 605 (col. 4, lines 30-34). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Fitch by using an undoped channel region for the purpose of simplifying the production process (by eliminating the doping step).

Regarding claim 33, Figure 10 of Fitch discloses the first doped region 28 is in electrical communication with the bit line 14.

Regarding claim 34, Figure 10 of Fitch discloses the gate 18 is adapted to be in electrical communication with a word line 18 (col. 7, lines 45 and 46). Note that the portion of the word line 18 adjacent to the dielectric layer 22 functions as the gate.

Regarding claims 35-40, Figures 6 and 10 of Fitch discloses the gate 18, overlies about all of the surface area of the intermediate region 30, the gate is generally annular and extends completely around the body, and the vertical epitaxy body is cylindrical. Since the first doped region is part of the epitaxy body, it is also cylindrical.

Claims 32-40 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda in view of Chew.

Regarding claims 76 and 32, Figures 2, 13-15, and 33 of Maeda disclose a vertical, selective epitaxy mesa 11/12/13 (or 6a/12/6b) extending from a horizontal substrate 1/201/24; a

first doped region 11 (or 6a) in the body adjacent the substrate, the first doped region laterally contacts a buried BL 30/31, and includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type; a second doped region 13 (6b) in the body remote from the substrate; and intermediate region 12 (channel) between the first and second doped regions; and a gate 25 at least partially surrounding the intermediate region. Note that in the embodiment of Fig. 33, when the selective epitaxy mesa is grown, the doped region 11 will laterally contact region 31, which is in contact with region 30. Region 30 is equivalent to region 24 of Fig. 2, and both are the bit line (BL) (buried conductive path) (col. 14, lines 20-24 and col. 19, line 25). Region 31 can be considered part of the buried conductive path since it is electrically connected to the BL 30. Also note that region 11 (region 6a) is doped using ion-implantation and diffusion (col. 17, lines 14-20). Since the implantation/diffusion occurs in from the vertical direction, the dopant profile will not be graded in the lateral direction. The difference between Maeda and the claimed invention is the intermediate (channel) region is undoped. The difference between Fitch and the claimed invention is the intermediate region (channel region) is undoped. Figure 6 of Chew discloses a vertical access device with an undoped, epitaxial channel region 605 (col. 4, lines 30-34). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Fitch by using an undoped channel region for the purpose of simplifying the production process (by eliminating the doping step).

Regarding claim 33, Figures 2 and 33 of Maeda disclose the first doped region 11 is adapted to be in electrical communication with the BL 30/31 (or 24).

Regarding claim 34, Figure 2 of Maeda discloses the gate 25 is adapted to be in electrical communication with a word line 25. Note that the portion of the word line 25 adjacent to the dielectric layer 4 functions as the gate.

Regarding claims 35-40, Figures 2 and 3 of Maeda disclose the gate 25, overlies about all of the surface area of the intermediate region 12, the gate is generally annular and extends completely around the body, and the vertical epitaxy body is cylindrical. Since the first doped region is part of the epitaxy body, it is also cylindrical.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda in view of Kurjanowicz et al. (US PGPub 2002/0131291, hereinafter Kur).

Regarding claim 30, Maeda does not disclose the electrical signal line 24 includes titanium. Kur discloses using titanium silicided wordlines (paragraph [0006], last 5 lines). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Maeda by included a layer of titanium silicide on the signal line for the purpose of reducing the effective resistance (see last 5 lines in paragraph [0006] of Kur).

Allowable Subject Matter

Claims 77-91 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

Response to Arguments

Applicant's arguments filed May 21, 2007 have been fully considered but they are not persuasive.

At the beginning of the "Remarks" section, Applicant states, "Applicant would like to bring to the Examiner's attention related application Serial No. 11/168,855 has now published as 2006/0289923". However, if Applicant would like the Examiner to consider the cited reference, it must be submitted in an IDS.

Applicant argues regarding the 112, 1st paragraph rejection of claim 12 by stating:

> "Figure 4A clearly illustrates an embodiment where the doped region 37 is not formed by horizontal diffusion, as taught by Applicant on pg 11, line 10 – pg. 12 line 6. Consequently, the cited doped region illustrates a laterally non-graded dopant profile".

Although Figure 4A could support a "laterally non-graded dopant profile", this embodiment does not disclose the "first source/drain region extends horizontally around the selective epitaxy mesa". The specification does not disclose an embodiment that has both the above mentioned claimed features. Therefore, the above limitation of claim 12 constitutes new matter.

Applicant argues regarding the 112, 1st paragraph rejection of claim 72 by stating:

> "Pg 5, lines 13-17 teach use of p-type dopants. For reasons of brevity and ease in understanding the inventions, Applicant indicated on Pg. 4, lines 10-13 that combinations of such teaching are possible. Therefore, one or more regions of mesa 36, including the regions denoted by Refs. 37 and 38, as well as conductive layer 33 was originally specified as being p-type in some embodiments. Applicant therefore believes claim 72 is sufficiently supported in the Detailed Description of the instant application."

However, neither section of the specification cited by applicant teach the use of p-type dopants. The only mention of p-type dopants in the specification is on pg. 11, lines 13 and 14, which state, "It will be recognized by one of skill that certain applications of the present invention may require P-type dopants such as boron". However, this passage is referring to the dopants used for doped regions 37 and 38 (see pg. 11, lines 10-15), not for the channel. As stated previously, the channel is undoped in the instant application. Therefore, no p-n junction exists in the embodiments of the instant application and claim 72 constitutes new matter.

Applicant argues regarding Fitch that "Applicant is unable to find any teaching of a dopant profile, let alone a non-graded dopant profile in a lateral direction. As stated in the above rejection, Fitch teaches region is doped 28 (col. 4, lines 43-48). Therefore, the region 28 will inherently have a dopant profile. Further, Fitch teaches region 28 is doped in-situ (col. 4, lines 43-48). Therefore, the dopant region will have a laterally non-graded dopant profile. It is considered in-situ doping will inherently have a laterally non-graded dopant profile, since Fitch does not disclose any special means (nor can the Examiner think of any possible way) to have a varying dopant concentration from one side to the other (in the lateral) direction when using in-situ doping.

Applicant argues regarding Maeda that:

> "Maeda et al., state in col. 19, lines 50-54 that region 30 is an SOI layer and region 31 is a silicide formed in the bottom of a contact hole and etched so to expose SOI layer 30. Therefore, Maeda et al., clearly contemplate separate conductive regions 30 and 31, one of which supplements conduction between the conductive path 30 and the channel region only in the region of the hole 10."

It is not clear how the above argument overcomes the rejection. Simply because conductive region 31 only contacts conductive bit line 30 in the hold does not mean region 31

cannot be considered part of the buried conductive path. Region 31 is electrically connected to region 30 and helps carry current from region 30 into the source/drain region. Therefore, it can be considered part of the buried conductive path.

Applicant further argues regarding Maeda by stating:

> "The Office Action further stated that "region 11 (region 6a) is doped using ion-implantation and diffusion (col. 17, lines 14-20). Since the implantation/diffusion occurs in from the vertical direction, the dopant profile will not be graded in the lateral direction." Applicant respectfully disagrees. Applicant can find no such teaching in Maeda et al. Applicant believes no such doping grading characteristic likely exists, and therefore respectfully requests the Examiner provide a reference describing such an element. Absent a reference, it appears that the Examiner is using personal knowledge, so the Examiner is respectfully requested to submit an affidavit as required by 37 C.F.R. § 1.104(d)(2)."

It appears Applicant has misunderstood the rejection. The Examiner was not relying on personal knowledge, or Official Notice to supply the allegedly missing teaching of the laterally non-graded dopant profile. The rejection stated that given the process conditions disclosed by Maeda, and the fact that Maeda does not disclose any graded dopant concentration, it is inherent that the doped regions of Maeda are laterally non-graded. The Examiner has provided a reasonable basis in fact and/or technical reason to support the position of inherency. Therefore, the burden is on Applicant to prove the doped regions of Maeda do not inherently have a laterally non-graded dopant profile (see MPEP 2112(IV) and (V)).

Applicant further argues regarding the 103 rejections in view of Chew et al. that the Examiner's motivation for combining the references is incorrect by stating:

> "Applicant believes the purpose behind use of such an undoped region is not to simplify a production process. Whether manufacturing is actually made simpler as a consequence is not relevant to any of the instant claims because Applicant is not claiming a simplified production method. Therefore, for at least this reason the issue is moot."

However, the Examiner never suggested that simplifying the production process was part of the claimed invention. The Examiner's was merely setting forth a motivation to combine the references as suggested in the rejection. Whether or not the production process is simplified is relevant since that is what would motivate one of ordinary skill in the art to combine use an undoped channel region as taught by Chew in the devices of Fitch and Maeda. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicant further argues that Fitch does not disclose the laterally non-graded dopant profile and "requests the Examiner provide a reference describing such an inherent feature". However, the Examiner is not required to provide a reference to support the position of inherency. The Examiner was not relying on personal knowledge, or Official Notice to supply the allegedly missing teaching of the laterally non-graded dopant profile. The rejection stated that given the process conditions disclosed by Fitch, and the fact that Fitch does not disclose any graded dopant concentration, it is inherent that the doped regions of Fitch are laterally non-graded. The Examiner has provided a reasonable basis in fact and/or technical reason to support the position of inherency. Therefore, the burden is on Applicant to prove the doped regions of Fitch do not inherently have a laterally non-graded dopant profile (see MPEP 2112(IV) and (V)).

Applicant further argues, "FIG. 4A clearly illustrates an embodiment where the dopant profile is abrupt. Contrast this with FIG. 4B illustrating an embodiment where the dopant has a diffusion profile. This is further described on pg. 11, line 24 – page 12, line 1." However, the

portion of the specification cited by Applicant does not discuss the dopant profile, whether it be graded or non-graded. Further, simply because Fig. 4B shows a dopant profile, does not mean that the dopant profile is "non-graded" as claimed. If Applicant believes that simply showing an abrupt junction between doped and non-doped (or oppositely doped) regions indicates a non-graded dopant profile, than this further supports the Examiner's position of inherency since both Fitch and Maeda show abrupt junctions for their respective doped regions.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is 571-272-1731. The examiner can normally be reached on 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew C. Landau
Primary Examiner
Art Unit 2815